

I. Population Estimate of Humpback Chub in Black Rocks.

II. Principal Investigator(s):

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III. Project Summary:

Robust population estimates are now critical to monitor recovery of the humpback chub population (USFWS 2001). Recovery goals require estimates of population size at regular intervals to measure population response to management activities under the Recovery Program. A population estimate was made for the 1998–2000 time period (McAda 2002) and 2003–2004 time period (McAda 2007). This report summarizes the work directed at a third estimate of population size for humpback chub in Black Rocks.

IV. Study Schedule: FY 2007 to FY 2009

V. Relationship to RIPRAP:
Colorado River Action Plan: Mainstem;
V.C. Estimate humpback chub populations;
V.C.1. Black Rocks

VI. Accomplishment of FY 2009 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Sampling for this study is conducted in September and October; therefore sampling overlaps two fiscal years. Sampling in calendar year 2007 overlapped into FY 2008 and sampling in calendar year 2008 overlapped into FY 2009. Data analysis for 2007 was conducted in FY 2008 and data analysis for 2008 and the final report is late with completion now scheduled in FY 2010. Therefore, this report will be segregated into calendar years 2007 and 2008.

Four sampling trips were conducted in September and October in both 2007 and 2008. The last sampling trip (for both years) was made during the final week of October.

In 2007, electrofishing was used more heavily than in the past. The entire Black Rocks reach was sampled with electrofishing during one early morning and one evening of each trip. During 2008, electrofishing was used for two of the four passes due to equipment malfunction. This meant that trammel nets could not be set for those time periods. In 2007, different sizes of trammel nets were used to attempt to minimize stress to the fish and capture a different size of fish. Trammel nets with 0.5-in inner mesh were used with mixed results. Smaller fish were collected, but catch rate was considerably less than with 1-in inner mesh. As a result, 2008 trammel nets with 1-in inner mesh were used exclusively, and managed to capture similar numbers of small fish. Fewer nets were set overall to minimize the time between net checks. Attempts were made to keep net sets to 1 to 1.25 hr long, which limited the number of nets that could be run at one time.

2007

A total of 62 individual humpback chubs were captured during fall 2007 (Figure 1); five of those fish were subsequently recaptured in a different sampling rotation of this study. Recapture rate improved generally over previous years. In addition to within year recaptures, a total of 14 humpback chubs were captured in previous years of sampling. Two of those fish were originally tagged in Westwater Canyon in 2003 and recaptured there in 2005. The remaining 12 fish were originally tagged at Black Rocks by Fish and Wildlife Service crews: four were tagged in 1999, five were tagged in 2003, and three were tagged in 2004.

A total of 410 individual roundtail chubs were collected from Black Rocks in fall 2007 (Figure 2). All roundtail chub were also equipped with PIT tags in 2007; 9 of those fish were recaptured in a subsequent sampling rotation. In addition, 5 roundtail chubs were recaptured that were originally tagged in Westwater Canyon; 1 in 2003, 1 in 2004, and 3 were tagged in 2005.

2008

A total of 74 individual humpback chub were captured during fall 2008 (Figure 1); four of those fish were subsequently recaptured in a different sampling rotation of this study. Recapture rate improved generally over previous years. 52 humpback chub had PIT tags inserted in 2008. In addition to within year recaptures, a total of 17 humpback chub were captured in previous years of sampling. Five of those fish were originally PIT tagged in Westwater Canyon: one was tagged in 2004, two were tagged in 2005 (one was recaptured there in 2007), and two were tagged in 2007. The remaining 12 fish were originally tagged at Black Rocks by Fish and Wildlife Service crews: two were tagged in 1999, five were tagged in 2003 (two were recaptured in 2003 and 2004, while two more were recaptured there in 2007), and five were tagged in 2007. Five humpback chub were positive recaptures that were not found in the database.

A total of 1008 individual roundtail chub were collected from Black Rocks in fall 2008 (Figure 2). 796 roundtail chub were also equipped with PIT tags in 2008, 38 were tagged in previous years or Westwater Canyon in fall 2008, and 174 roundtail chub were not PIT tagged due to an unexplainable large pulse of fish captured and a tag shortage. 14 of those fish were recaptured in a subsequent sampling rotation. In addition, 29 roundtail chub were tagged in earlier years. 12 roundtail chub were recaptured that were originally tagged in Westwater Canyon; 2 in 2004, 2 in 2005, and 8 were tagged in 2007. The 17 remaining roundtail chub were originally tagged at Blackrocks by Fish and Wildlife crews in 2007. Nine roundtail chub were positive recaptures that were not found in the database.

Population Estimates

Gary C White, of the Department of Fish, Wildlife, and Conservation Biology at CSU, utilized program MARK to generate the population estimates and capture probabilities for roundtail chub and humpback chub in both 2007 and 2008, respectively. The top model for both species was model M_t of CAPTURE for each year, but with total length used as an individual covariate to model detection probabilities across both years. Model averaging was unnecessary considering M_t had most of the weight. The estimates from program MARK are presented below.

Estimates of Derived Parameters							Capture Probabilities P-hat							
Population Estimates of $\{S(.)(p(\text{year} \cdot t + TL)=c(\text{year} \cdot t + TL))\}$							Based on user-specified 280 mm total length individual covariate							
95% Confidence Interval							Pass 1		Pass 2		Pass 3		Pass 4	
Species	Year	N-hat	SE	Lower	Upper	CV	Pass 1	95% CI	Pass 2	95% CI	Pass 3	95% CI	Pass 4	95% CI
HB	2007	345.082	146.126	170.907	795.282	42.345	0.033	.012-.088	0.036	.014-.094	0.045	.017-.112	0.07	.028-.166
HB	2008	286.898	79.154	179.167	504.985	27.59	0.145	.078-.252	0.062	.031-.121	0.055	.027-.109	0.025	.01-.061
RT	2007	7229.584	2569.482	3747.744	14335.981	35.541	0.005	.002-.011	0.004	.002-.009	0.021	.01-.042	0.04	.02-.079
RT	2008	12937.942	2322.235	9182.467	18417.263	17.95	0.011	.008-.016	0.008	.005-.012	0.027	.019-.039	0.05	.036-.07

These estimates for humpback chub are fairly decent when compared to previous year's estimates. The confidence intervals are reasonable, the CV value is better in 2008, and in most passes the probability of capture was higher. The estimates appear low; however, they fall within the bounds of the estimates obtained in 2003 and 2004. Total length, as an individual covariate, takes out a bit of the individual heterogeneity that causes population estimates to be biased low. The higher incidence of recaptures from previous years (when compared to within year recaptures) could suggest poor sampling efficiency or trap shyness. Total number of fish collected and mean catch per effort have been about the same in 2003–2004 and 2007–2008 so it is very unlikely that the population size has changed very much.

These estimates for roundtail chub are poor. Roundtail chub are not confined to Blackrocks and negate the models assumption of population closure. The poor capture

probabilities are a good indication that a majority of this population is just moving through the study area. Total number of fish collected and mean catch per effort have increased from 2003–2004 and is concerning with regards to potential genetic mixing with the humpback population.

Size structure was similar among years for both species. Humpback chub's size structure showed a slight shift to larger fish in 2008 (Appendix).

- VII. Recommendations: Continue data analysis and report writing.

- II Project Status: Project is slightly behind schedule. With office management change, my administrative workload temporarily increased.

- IX. FY Budget:
 - A. Funds Provided: \$ 35,162
 - B. Funds Expended: \$ 35,162
 - C. Difference: \$ 0
 - D. Percent of the FY 2009 work completed: 85%
 - E. Recovery Program funds spent for publication charges: \$0

- X. Status of Data Submission: Submitted.

- XI. Signed: T.A. Francis 11/11/09

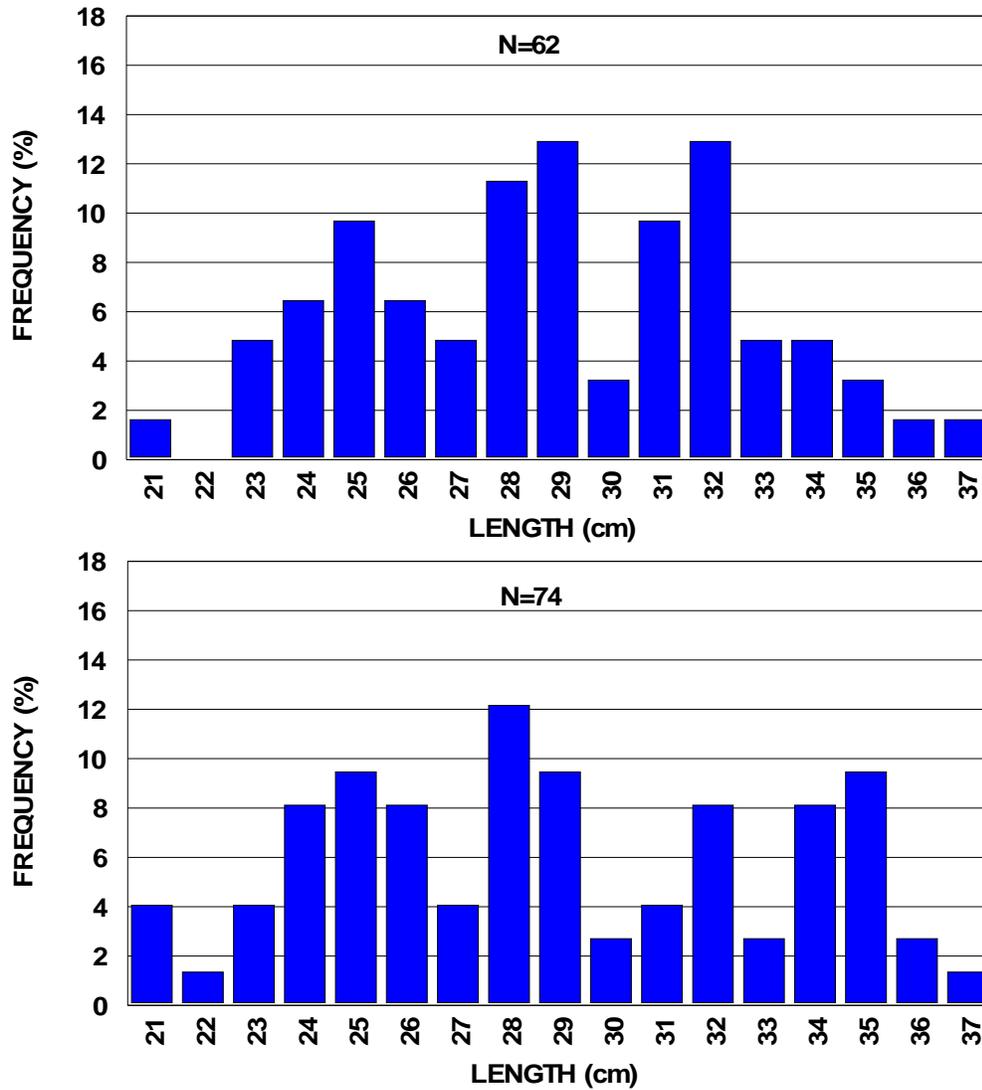


Figure 1. Length frequency of humpback chub captured in Black Rocks, Colorado River, autumn, 2007 and 2008.

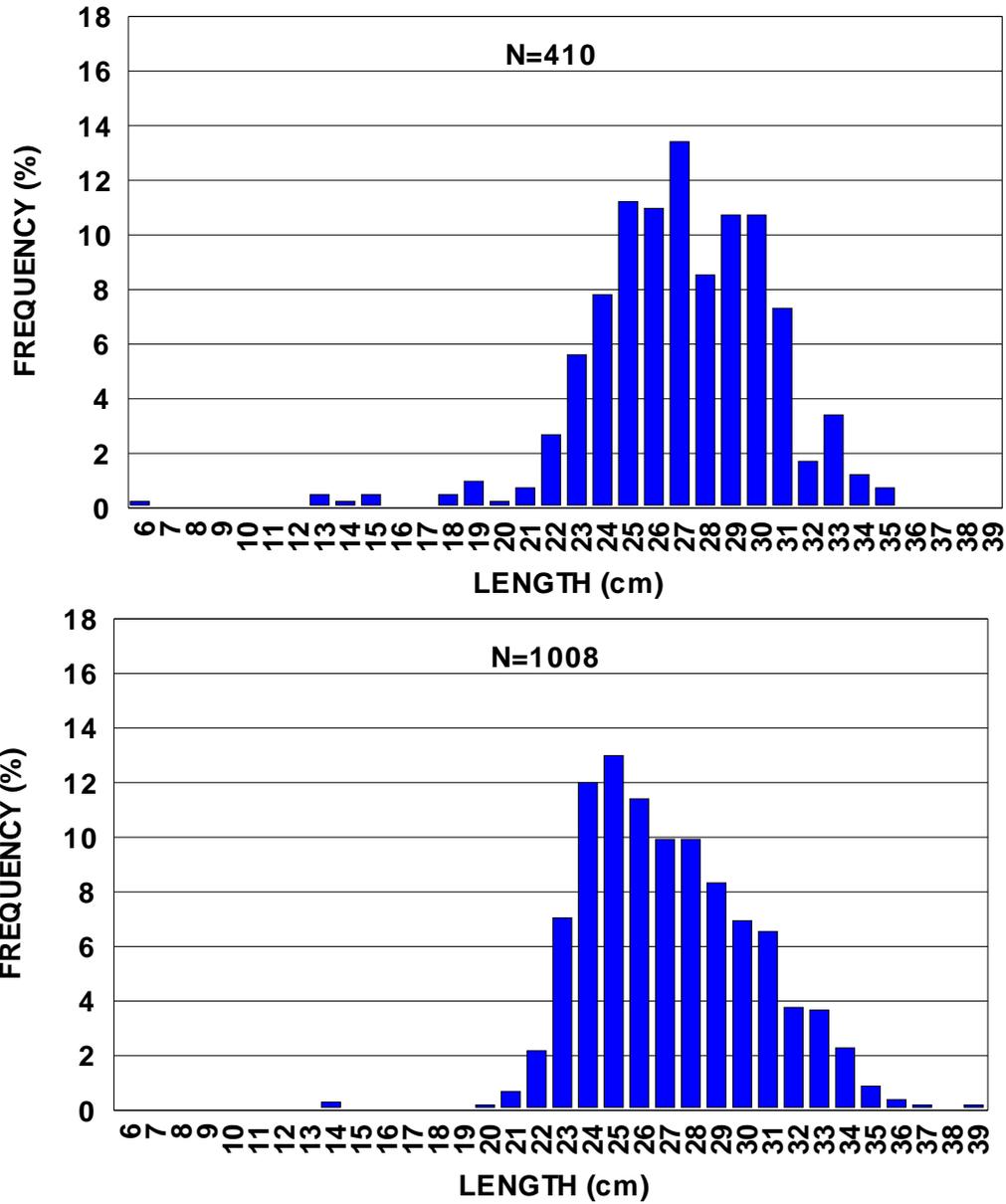


Figure 2. Length frequency of roundtail chub captured in Black Rocks, Colorado River, autumn, 2007 and 2008.